DBMS Lab Experiment 06

Use of Inbuilt Functions and Relational Algebra Operations

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- **Semester:** 3
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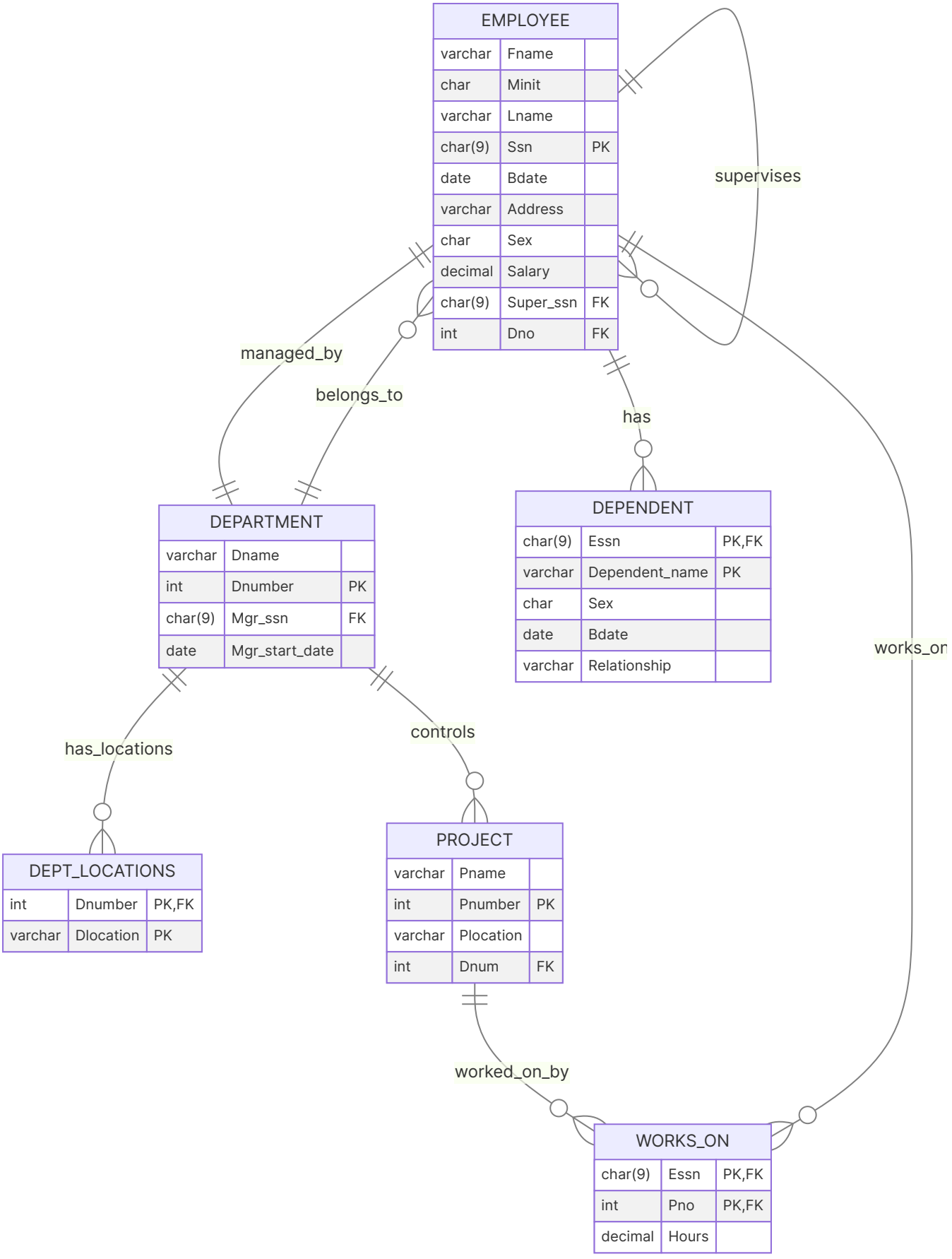
Schema Reference

Database Relations and Attributes



Query Solutions

Q 1. Retrieve the first name, last name, and salary of all employees.

Problem Statement: Retrieve the first name, last name, and salary of all employees.

Relational Algebra:

$$\pi_{Fname,Lname,Salary}(EMPLOYEE)$$

SQL Query:

```sql
SELECT fname, lname, salary
FROM employee
ORDER BY salary DESC;
```

Result Evidence:

fname	lname	salary
Deepak	Agarwal	150000.00
Neha	Chopra	125000.00
Sunita	Reddy	110000.00
Priya	Patel	95000.00
Rohit	Malhotra	88000.00
Vikram	Gupta	82000.00
Rajesh	Sharma	75000.00
Amit	Singh	65000.00
Arjun	Joshi	62000.00
Kavya	Iyer	58000.00

Explanation: This query projects the first name, last name, and salary columns from the EMPLOYEE relation, returning all Indian employee records with these three attributes.

Q 2. Retrieve the names of all projects located in Mumbai.

Problem Statement: Retrieve the names of all projects located in Mumbai.

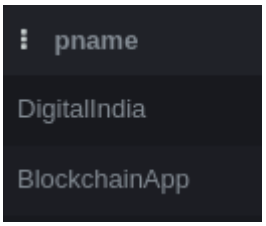
Relational Algebra:

$$\pi_{Pname}(\sigma_{Plocation='Mumbai'}(PROJECT))$$

SQL Query:

```sql
SELECT pname
FROM project
WHERE UPPER(plocation) = UPPER('Mumbai');
```

Result Evidence:



pname
DigitalIndia
BlockchainApp

Explanation: This query selects projects where the location matches 'Mumbai', using UPPER () function for case-insensitive comparison.

Q 3. List the names and birth dates of employees whose salary is greater than 100,000.

Problem Statement: List the names and birth dates of employees whose salary is greater than 1,00,000 (1 Lakh).

Relational Algebra:

$$\pi_{Fname,Minit,Lname,Bdate}(\sigma_{Salary>100000}(EMPLOYEE))$$

SQL Query:

```sql
SELECT fname, minit, lname, bdate, salary
FROM employee
WHERE salary > 100000
ORDER BY salary DESC;
```

Result Evidence:

fname	minit	lname	bdate	salary
Deepak	L	Agarwal	1975-02-28	150000.00
Neha	K	Chopra	1983-06-10	125000.00
Sunita	M	Reddy	1980-04-18	110000.00

Explanation: This query filters employees with salary greater than 1,00,000 and projects their names and birth dates.

Q 4. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the 'DigitalIndia' project.

Problem Statement: Retrieve the names of all employees in department 5 who work more than 10 hours per week on the 'DigitalIndia' project.

Relational Algebra:

$$\pi_{Fname,Minit,Lname}(\sigma_{Dno=5}(EMPLOYEE) \bowtie_{Ssn=Essn} \sigma_{Hours>10}(WORKS\_ON) \bowtie_{Pno=Pnumber} \sigma_{Pname=}$$

SQL Query:

```sql
SELECT DISTINCT e.fname, e.minit, e.lname, w.hours
FROM employee e
INNER JOIN works_on w ON w.essn = e.ssn
INNER JOIN project p ON p.pnumber = w.pno
WHERE e.dno = 5
  AND UPPER(p.pname) = UPPER('DigitalIndia')
  AND w.hours > 10;
```

Result Evidence:

fname	minit	lname	hours
Kavya	N	Iyer	20.0
Rajesh	K	Sharma	32.5

Explanation: This query joins three relations to find employees in department 5 working more than 10 hours on DigitalIndia project.

Q 5. List the names of all employees who have a dependent with the same first name as themselves.

Problem Statement: List the names of all employees who have a dependent with the same first name as themselves.

Relational Algebra:

$$\pi_{Fname,Minit,Lname}(EMPLOYEE \bowtie_{Ssn=Essn \wedge Fname=Dependent\_name} DEPENDENT)$$

SQL Query:

```sql
SELECT DISTINCT e.fname, e.minit, e.lname, d.dependent_name
FROM employee e
```

```
INNER JOIN dependent d ON e.ssn = d.essn
WHERE UPPER(e.fname) = UPPER(d.dependent_name);
```

Result Evidence:

fname	minit	lname	dependent_name
Kavya	N	Iyer	Kavya
Priya	S	Patel	Priya
Vikram	A	Gupta	Vikram

Explanation: This query finds employees whose first name matches any of their dependents' names using case-insensitive comparison.

Q 6. Find the names of employees who are directly supervised by 'Priya Patel'.

Problem Statement: Find the names of employees who are directly supervised by 'Priya Patel'.

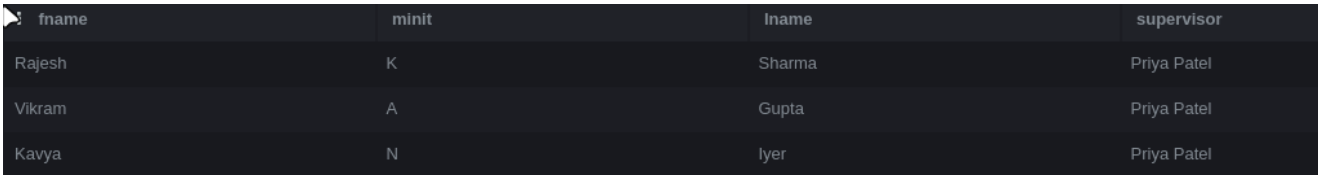
Relational Algebra:

$$\pi_{E2.Fname,E2.Minit,E2.Lname}(\rho_{E1}(\sigma_{Fname='Priya' \wedge Lname='Patel'}(EMPLOYEE)) \bowtie_{E1.Ssn=E2.Super\_ssn} \rho_{E2}(EM$$

SQL Query:

```
SELECT e2.fname, e2.minit, e2.lname,
       CONCAT(e1.fname, ' ', e1.lname) AS supervisor
FROM employee e1
INNER JOIN employee e2 ON e1.ssn = e2.super_ssn
WHERE UPPER(e1.fname) = UPPER('Priya')
  AND UPPER(e1.lname) = UPPER('Patel');
```

Result Evidence:



fname	minit	lname	supervisor
Rajesh	K	Sharma	Priya Patel
Vikram	A	Gupta	Priya Patel
Kavya	N	Iyer	Priya Patel

Explanation: This self-join query finds all employees supervised by Priya Patel by matching supervisor SSN.

Q 7. Retrieve the names of employees who work on every project.

Problem Statement: Retrieve the names of employees who work on every project.

Relational Algebra:

$$\pi_{Fname,Minit,Lname}((\pi_{Essn}(WORKS\_ON) \div \pi_{Pnumber}(PROJECT)) \bowtie_{Essn=Ssn} EMPLOYEE)$$

SQL Query:

```sql
SELECT e.fname, e.minit, e.lname
FROM employee e
WHERE NOT EXISTS (
    SELECT p.pnumber
    FROM project p
    WHERE NOT EXISTS (
        SELECT w.pno
        FROM works_on w
        WHERE w.essn = e.ssn AND w.pno = p.pnumber
    )
);
```

Result Evidence:

Explanation: This query uses division operation (implemented with double NOT EXISTS) to find employees working on all projects.

Q 8. Retrieve the names of employees who do not work on any project.

Problem Statement: Retrieve the names of employees who do not work on any project.

Relational Algebra:

$$\pi_{Fname,Minit,Lname}(EMPLOYEE - \pi_{Ssn}(EMPLOYEE \bowtie_{Ssn=Essn} WORKS\_ON))$$

SQL Query:

```sql
SELECT e.fname, e.minit, e.lname
FROM employee e
WHERE e.ssn NOT IN (
    SELECT DISTINCT w.essn
```

```
    FROM works_on w
    WHERE w.essn IS NOT NULL
);
```

Result Evidence:

Explanation: This query finds employees whose SSN does not appear in the WORKS_ON relation.

Q 9. Retrieve the names and addresses of all employees who work on at least one project located in Mumbai but whose department has no location in Mumbai.

Problem Statement: Retrieve the names and addresses of all employees who work on at least one project located in Mumbai but whose department has no location in Mumbai.

Relational Algebra:

$$\pi_{Fname,Minit,Lname,Address}((EMPLOYEE \bowtie_{Ssn=Essn} WORKS\_ON \bowtie_{Pno=Pnumber} \sigma_{Plocation='Mumbai'}(P$$

SQL Query:

```sql
SELECT DISTINCT e.fname, e.minit, e.lname, e.address
FROM employee e
INNER JOIN works_on w ON e.ssn = w.essn
INNER JOIN project p ON w.pno = p.pnumber
WHERE UPPER(p.plocation) = UPPER('Mumbai')
  AND e.dno NOT IN (
    SELECT dl.dnumber
    FROM dept_locations dl
    WHERE UPPER(dl.dlocation) = UPPER('Mumbai')
  );
```

Result Evidence:

Explanation: This query finds employees working on Mumbai projects whose departments don't have Mumbai locations.

Q 10. Retrieve the last names of all department managers who have no dependents.

Problem Statement: Retrieve the last names of all department managers who have no dependents.

Relational Algebra:

$$\pi_{Lname}((\pi_{Mgr\_ssn}(DEPARTMENT) \bowtie_{Mgr\_ssn=Ssn} EMPLOYEE) - \pi_{Ssn}(EMPLOYEE \bowtie_{Ssn=Essn}$$

SQL Query:

```sql
SELECT DISTINCT e.fname, e.lname, d.dname
FROM employee e
INNER JOIN department d ON e.ssn = d.mgr_ssn
WHERE e.ssn NOT IN (
    SELECT DISTINCT dep.essn
    FROM dependent dep
    WHERE dep.essn IS NOT NULL
);
```

Result Evidence:

Explanation: This query finds department managers who don't appear in the DEPENDENT relation as having any dependents.
